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(54) Lift truck

(57) A lift truck (10) for lifting crates of goods and the like comprising a body (12) having ground engaging means (16,34), a lifting device (14) having a mast and means (24) for lifting goods (26,28) with respect to the mast which lifting device is pivotally attached to the body

about a first axis (32), at least one steerable wheel (34) proximal the lifting device which wheel is pivotable about a second axis (40) to enable steering of the truck, and means for independently pivoting the lifting device about the first axis and the steerable wheel about the second axis.

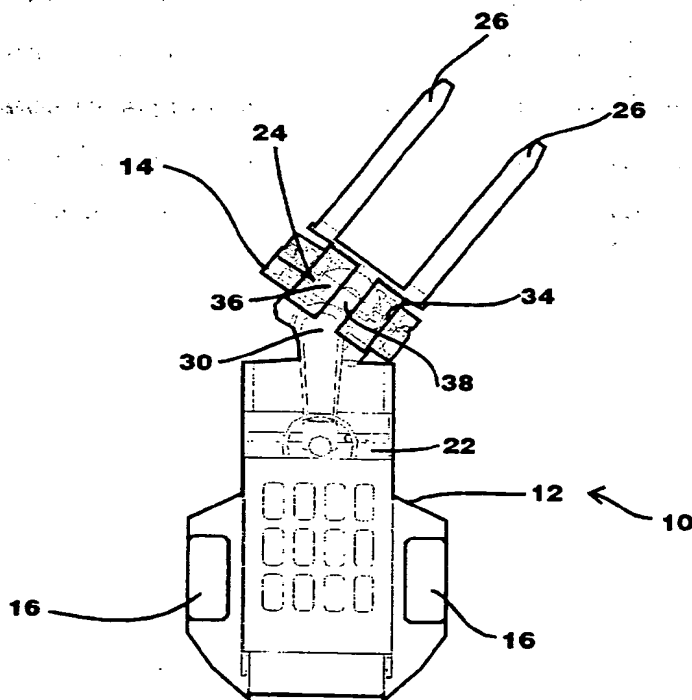


Figure 1

Description

The invention relates to lift trucks also known as forklift trucks used for manoeuvring loads such as crates of goods and the like. More particularly, the invention relates to such trucks adapted for use in narrow aisle warehouses which trucks are highly manoeuvrable.

A known truck of this type is disclosed in WO91/01938 which describes a narrow aisle lift truck having a pair of rear drive wheels and a forward pair of wheels fixedly attached to a lifting device comprising a mast, lifting mechanism and lifting forks. The lifting device is pivotally connected to the main body of the truck such that rotational movement of the lifting device about the pivot axis acts both to steer the direction of movement of the vehicle and any goods held by the forks. In order to provide increased manoeuvrability, WO91/01938 provides reversible independent drives to each of the rear wheels.

An object of the invention is to provide greater performance than that known from prior art trucks and especially to provide greater manoeuvrability in narrow aisles. A further object of the invention is to provide a truck capable of handling long loads in narrow aisle warehouses.

According to one aspect of the invention there is provided a lift truck for lifting crates of goods and the like comprising a body having ground engaging means, a lifting device having a mast and means for lifting goods with respect to the mast which lifting device is pivotally attached to the body about a first axis, at least one steerable wheel proximal the lifting device which wheel is pivotable about a second axis to enable steering of the truck, and means for independently pivoting the lifting device about the first axis and the steerable wheel about the second axis. Beneficially therefore the direction of movement of a truck can be determined by the steerable wheel and/or lifting device and the goods can be handled and directed in a different direction to the movement of the truck. Additionally, increased manoeuvrability is provided.

Preferably the second axis is positioned further from the truck body than the first axis and more preferably the steerable wheel is below the lifting means thereby to provide good stability of the truck in use.

In one form, the steerable wheel is pivotally attached to the lifting device and in another form the steerable wheel is pivotally attached to the body and therefore entirely independent of the lifting device.

Preferably the truck comprises two steerable wheels which are axially separated along a common rotational axis. In one form, the two steerable wheels are connected to the truck at a common pivot providing the second axis. Preferably the second axis is disposed between the wheels. In another form, the truck comprises two steerable wheels each being pivotal about independent second axes. Accordingly, each steerable wheel is attached to the truck, at either the body or the

lifting device, at a separate point.

According to another aspect of the invention a lift truck of the generally known type is provided wherein the body is adapted to allow a load operably to be positioned over part of the body thereby enabling the centre of gravity of the load to be kept close to the centre of gravity of the truck. Beneficially, the lifting device is adapted to position the load to one side of the body whilst still allowing the truck to move in a forward and other directions. Therefore, a long load can be positioned on the lifting device and preferably can also be supported by part of the truck body. For example, a body part above rear drive wheels can be kept low and a support means provided for the load in the vicinity of the body part.

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

FIGURE 1 is a plan view of a truck according to the invention;

FIGURE 2 is a side elevation view of the truck shown in Figure 1;

FIGURE 3 is a plan view of the truck shown in Figures 1 and 2 at four different stages of manoeuvring a load into a space;

FIGURE 4 is a rear elevation view of the truck shown in Figure 1 having a load positioned to the side of the vehicle;

FIGURE 5 is a plan view of the truck shown in Figure 4 during two stages of manoeuvring a long load;

FIGURE 6 is a partial plan view of a second embodiment of a truck according to the invention;

FIGURE 7 is a partial plan view of a third embodiment of a truck according to the invention; and

FIGURE 8 is a plan view of the invention showing in particular details of the drive mechanisms.

Referring to Figures 1 and 2, there is shown a truck 10 according to the invention comprising a body 12 and lifting device 14. Body 12 comprises a pair of rear wheels 16, a cabin 18 housing a seat 20 and steering and lifting controls 22 and 22a. The lifting device 14 comprises a mast 24, forks 26 and a mechanism 28 for raising and lowering of the forks on the mast. The lifting mechanism 28 can comprise hydraulic and/or chain and sprocket mechanisms for example. Lifting device 14 is pivotally attached to body 12 at a pivot hinge or bearing 30 having a pivot axis 32.

Truck 10 further comprises front steerable wheels 34 rotatable about a common horizontal axis 36. The

steerable wheels are pivotally attached by a pivot 38 having a pivot axis 40 to a plate 42. Plate 42 is in turn connected, in this embodiment, to lifting device 14. In this configuration, axes 40 and 32 are alignable along the longitudinal axis of the truck 10, with axis 40 furthest from the body 12, and beneath device 14.

Independent mechanisms (described later in relation to Figure 8) are provided for effecting rotation of the lifting device 14 about axis 32 and for rotating steerable wheels 34 about axis 40. Additionally, a drive system such as a combustion engine is provided in body 12 for driving any one of wheels 16 and 34. Preferably, means is provided for driving any wheel in a forward or reverse direction.

Figure 3 shows four different plan views of a procedure of placing a load L into a storage bay using truck 10. As can be seen from Figure 3a, truck 10 can be used with axes 40 and 32 substantially in line along the longitudinal axis of the truck to drive load L in a forward (or reverse) direction. To manoeuvre the load L into a storage bay (or other predetermined position) lifting device 14, and accordingly forks 26 and load L, are rotated about axis 30. The angle of movement of the truck and the load L can also be adjusted by rotation of steerable wheels 34 about axis 40. By suitable manoeuvring of steerable wheels 34 and lifting device 14, it is possible to maintain the truck body 10 substantially at right angles to the direction of movement of load L. Accordingly, truck 10 enables the positioning of loads L in narrow aisles.

A rear view elevation of truck 10 is shown in Figure 4 where a long load L is supported on forks 26. As can be seen in Figure 4, in this version cabin 18 is relatively narrow compared to the width of the body 12. Shoulder panels 44 are provided above wheels 16 and it is possible to carry a load L in a relatively low position wherein part of the load passes over a shoulder portion 44 of body 10 on one side of the truck. Indeed, it is possible, as shown in Figure 4 for load L to abut the shoulder 44. Shoulder 44 can be provided with internal supports for increased load handling. Beneficially therefore, whilst the centre of gravity of a long load should be positioned between forks 26, it is possible to carry some of the load on shoulder 44. Moreover, it is possible to keep the centre of gravity of the load close to truck 10 thereby to increase stability of the truck in use. Figure 5 shows the benefit of manoeuvrability of truck 10 in handling a long load L. Lifting device 14 is positioned at right angles to the longitudinal axis of the truck. This causes pivot 38 to be displaced to one side of the truck as shown in Figure 5a. However, the independent steering mechanism to steer wheels 34 enables the truck to continue in a forward direction. Additionally, the load can be manoeuvred sideways into an appropriate bay through suitable rotation by a driver of the steerable wheels and lifting device about axes 40 and 32 respectively.

A further embodiment of the invention is shown in Figure 6 wherein a pair of steerable wheels 134a and

134b is provided each having an independent rotation axes 136a and 136b respectively. Additionally, each steerable wheel 134a and 134b has a separate pivot 138a and 138b respectively and first axis about which it can be steered. In the embodiment shown in Figure 6 the pivots 138a and 138b are attached to lifting device 114. Beneficially the axial separation of steer wheels 134a and 134b along axis 136 provides greater lateral stability of a truck 100.

A further embodiment is shown in Figure 7 wherein wheels 234a and b each comprise separate pivots 238a and b respectively. The pivots are attached to body 212 independent of lifting device 214.

Referring to Figure 8, the independent drive means are shown. The complete assembly (i.e. the lifting device 14) is steered by rotating motor 64, which in turn drives steer chain 62. Steer wheels 34 are steered by rotating motor 63, which in turn drives steer chain 65.

The motor could be hydraulic or electrically controlled. Power from the steering wheel 22 can be directed to either motor 63 or 64. Both motors steer the truck, however with motor 64 the whole assembly (14) turns (i.e. the mast, forks and steer wheels).

For example a switch can be provided such as a lever to change control by the steering wheel to either motor 63 or 64. However, a separate steering wheel can be provided to drive motor 63 and accordingly a driver can, with practise, steer the truck using both steering wheels at the same time.

When steering motor 63 is powered then only the steered wheels 34 turn, leaving the forks stationary. This increases manoeuvrability dramatically. The lifting mechanism 14 is mounted above the steer wheels 34 and consists of a conventional telescopic construction. It could be fed hydraulically and is fixed above plate 66. To turn the forks together with the lifting mechanism 14, motor 64 is powered by operating the steering 22 through that particular circuit. The forks are normally powered up and down by hydraulic pressure operated by a separate hand control lever 22a.

Claims

1. A lift truck for lifting crates of goods and the like comprising a body having ground engaging means, a lifting device having a mast and means for lifting goods with respect to the mast which lifting device is pivotally attached to the body about a first axis, at least one steerable wheel proximal the lifting device which wheel is pivotable about a second axis to enable steering of the truck, and means for independently pivoting the lifting device about the first axis and the steerable wheel about the second axis.
2. A lift truck according to Claim 1 wherein the pivoting means enables the direction of movement of a truck to be determined by the steerable wheel and/or lift-

ing device and the goods to be handled and directed in a different direction to the movement of the truck.

3. A lift truck according to Claim 1 or 2 wherein the second axis is positioned further from the truck body than the first axis. 5
4. A lift truck according to Claim 1, 2 or 3 wherein the steerable wheel is below the lifting means thereby to provide good stability of the truck in use. 10
5. A lift truck according to any preceding claim wherein the steerable wheel is pivotably attached to the lifting device. 15
6. A lift truck according to any of Claims 1 to 4 wherein the steerable wheel is pivotably attached to the body and therefore independent of the lifting device.
7. A lift truck according to any preceding claim which comprises two steerable wheels which are axially separated along a common rotational axis. 20
8. A lift truck according to Claim 7 wherein the two steerable wheels are connected to the truck at a common pivot providing the second axis. 25
9. A lift truck according to Claim 8 wherein the second axis is disposed between the wheels. 30
10. A lift truck according to any of Claims 1 to 8 comprising two steerable wheels each pivotal about independent second axes.
11. A lift truck according to any preceding claim wherein the body is adapted to allow a load operably to be positioned over part of the body thereby enabling the centre of gravity of the load to be kept close to the centre of gravity of the truck. 35
12. A lift truck according to Claim 11 wherein the lifting device is adapted to position the load to one side of the body whilst still allowing the truck to move in a forward and other directions. 40
13. A lift truck according to Claim 11 or 12 wherein a long load is positionable on the lifting device and supportable by part of the truck body. 45
14. A lift truck according to any of Claims 11 to 13 wherein a body part above rear drive wheels is low and support means is provided for a load in the vicinity of the body part. 50

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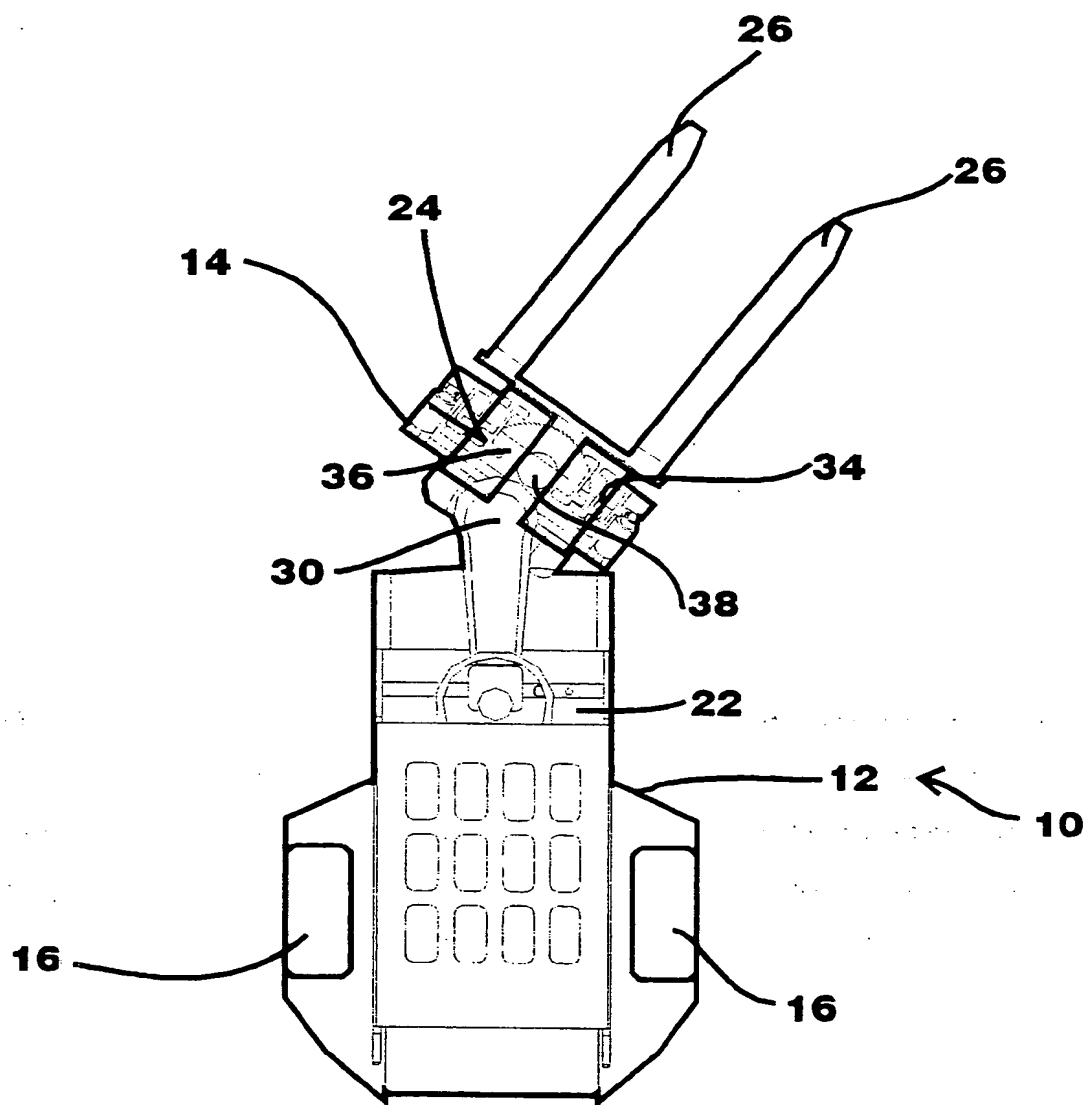
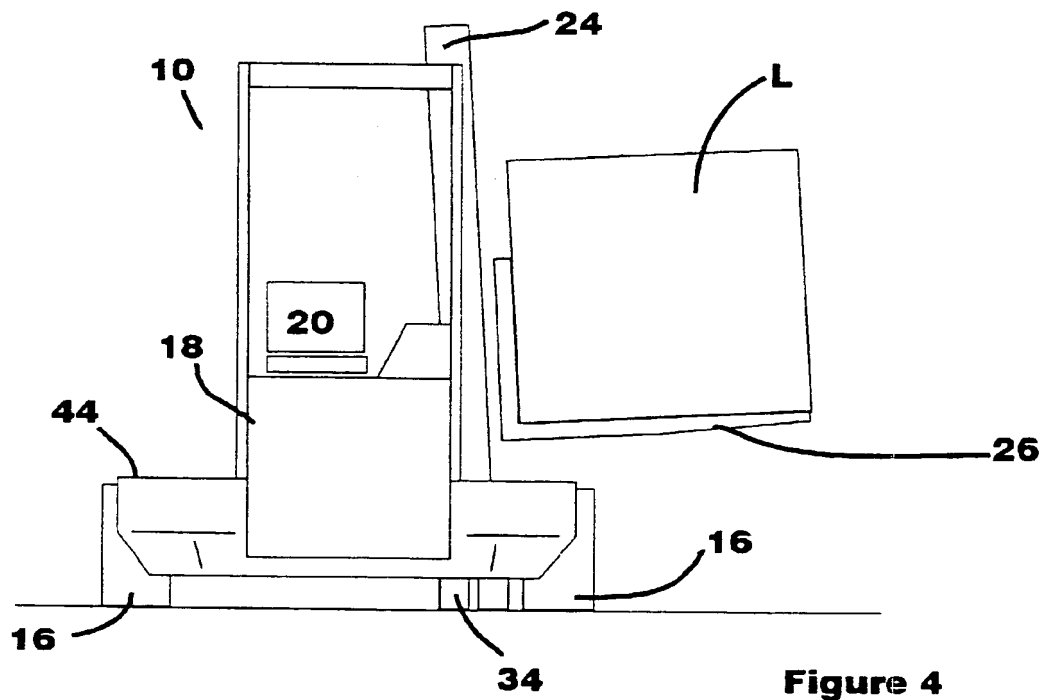
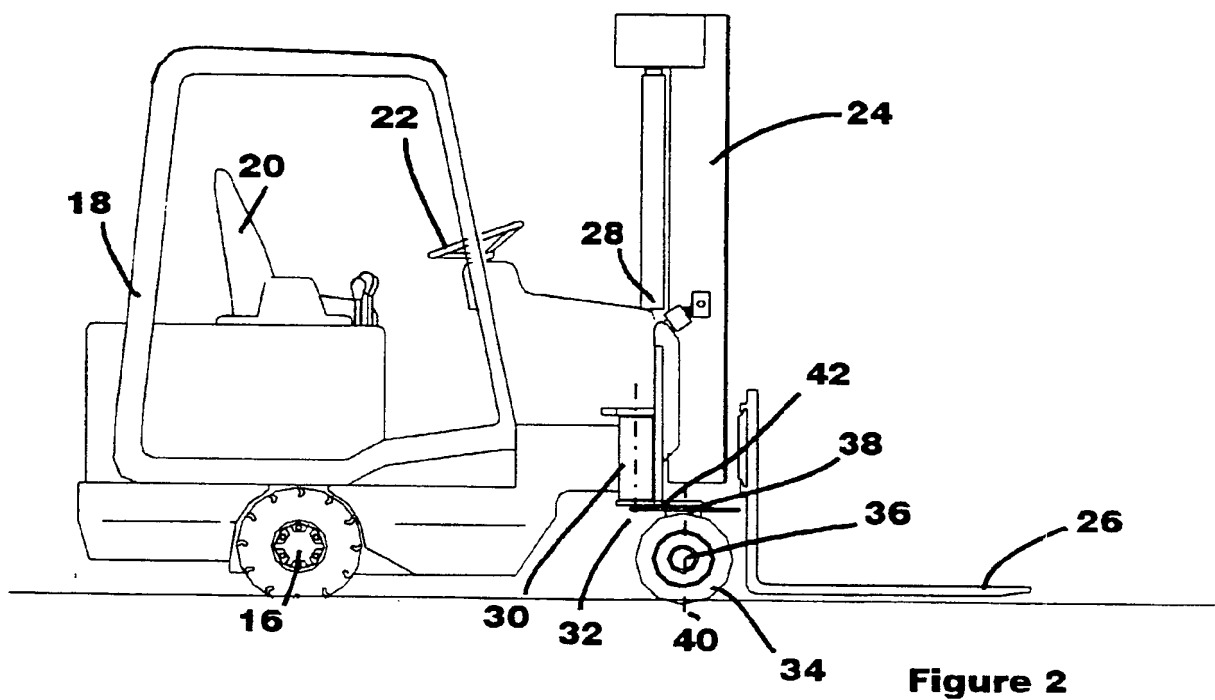
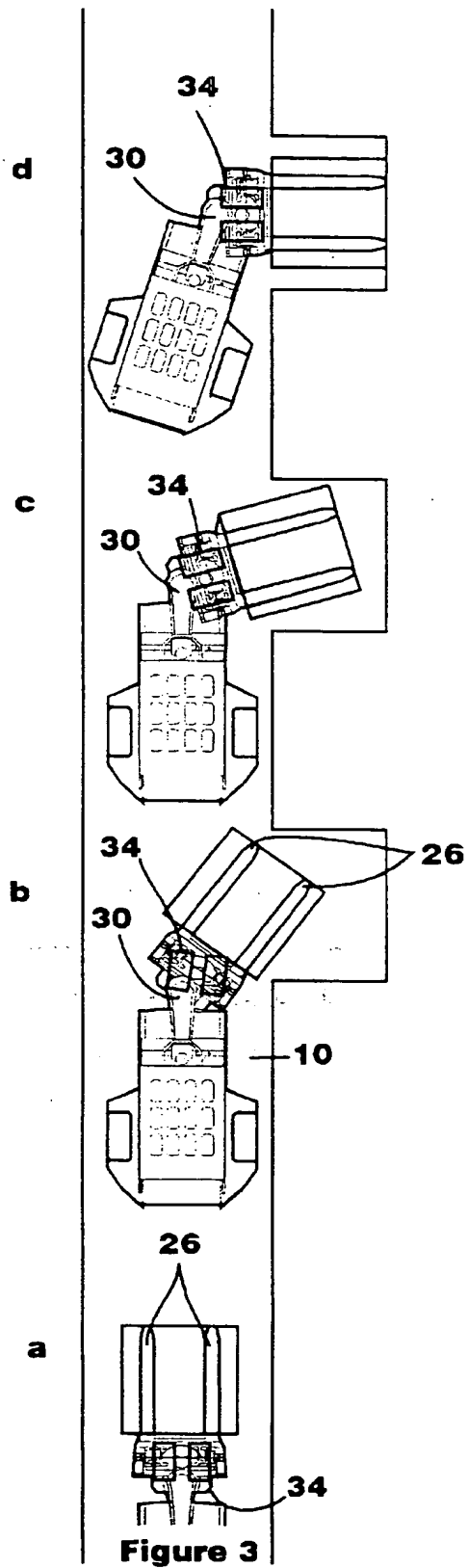


Figure 1





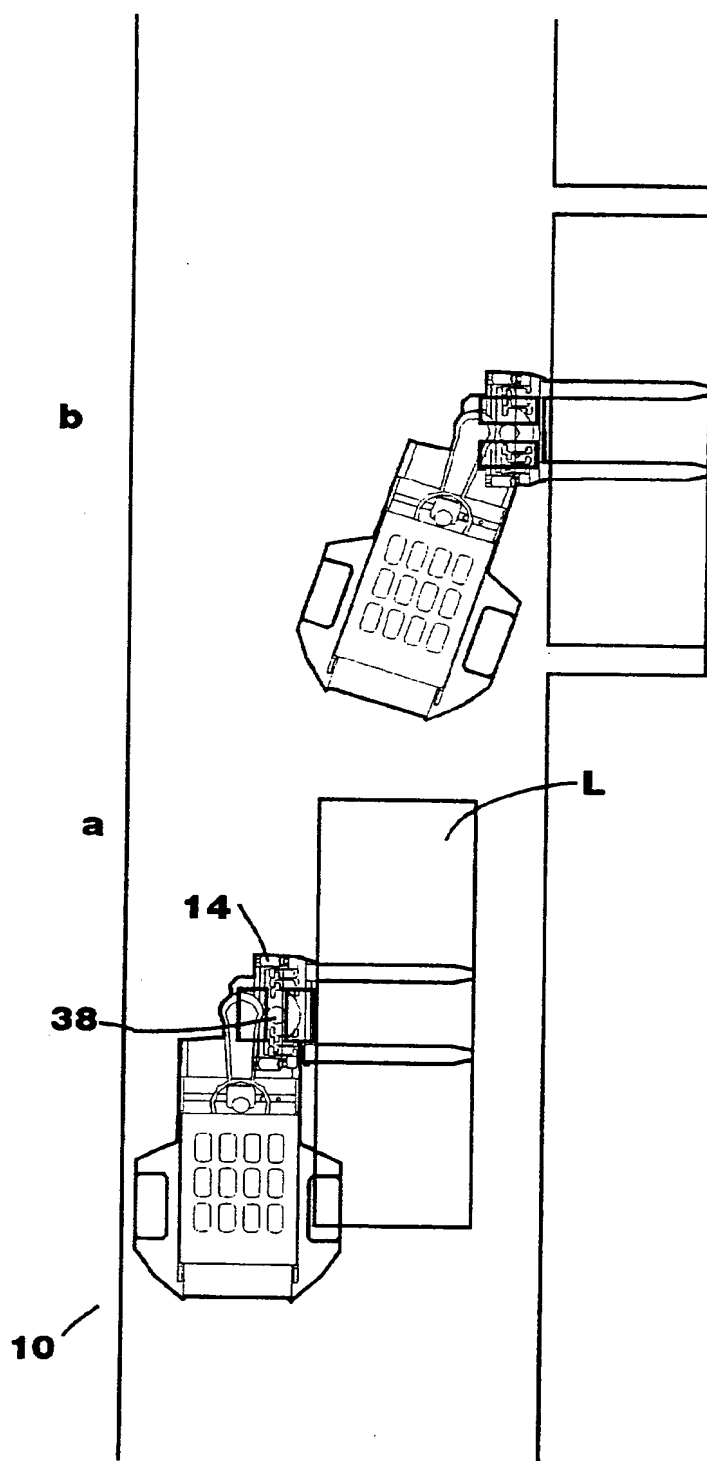


Figure 5

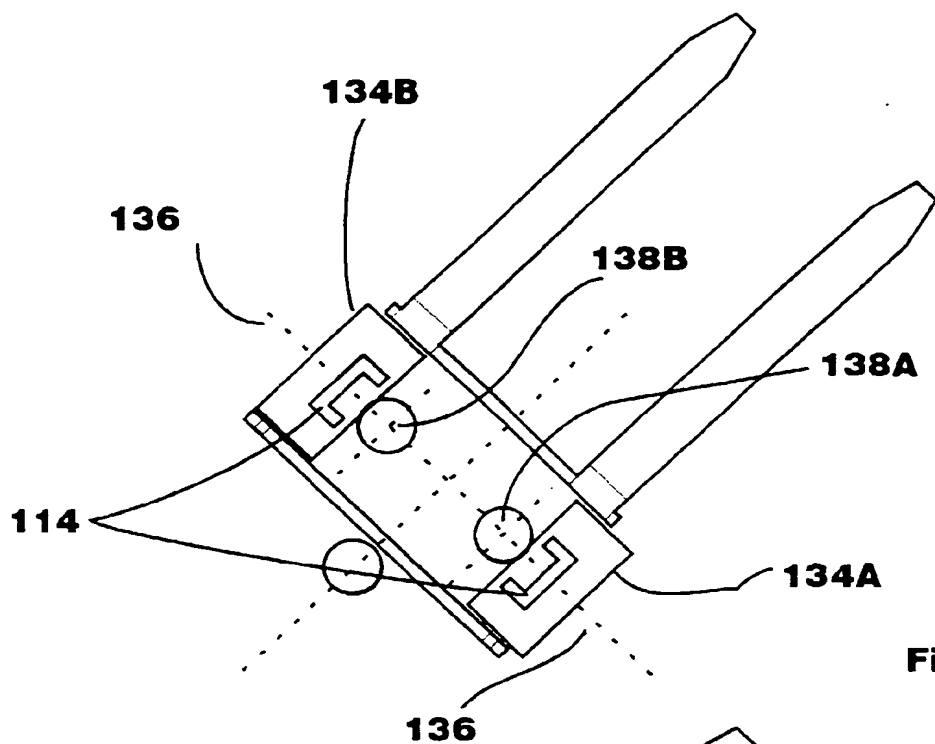


Figure 6

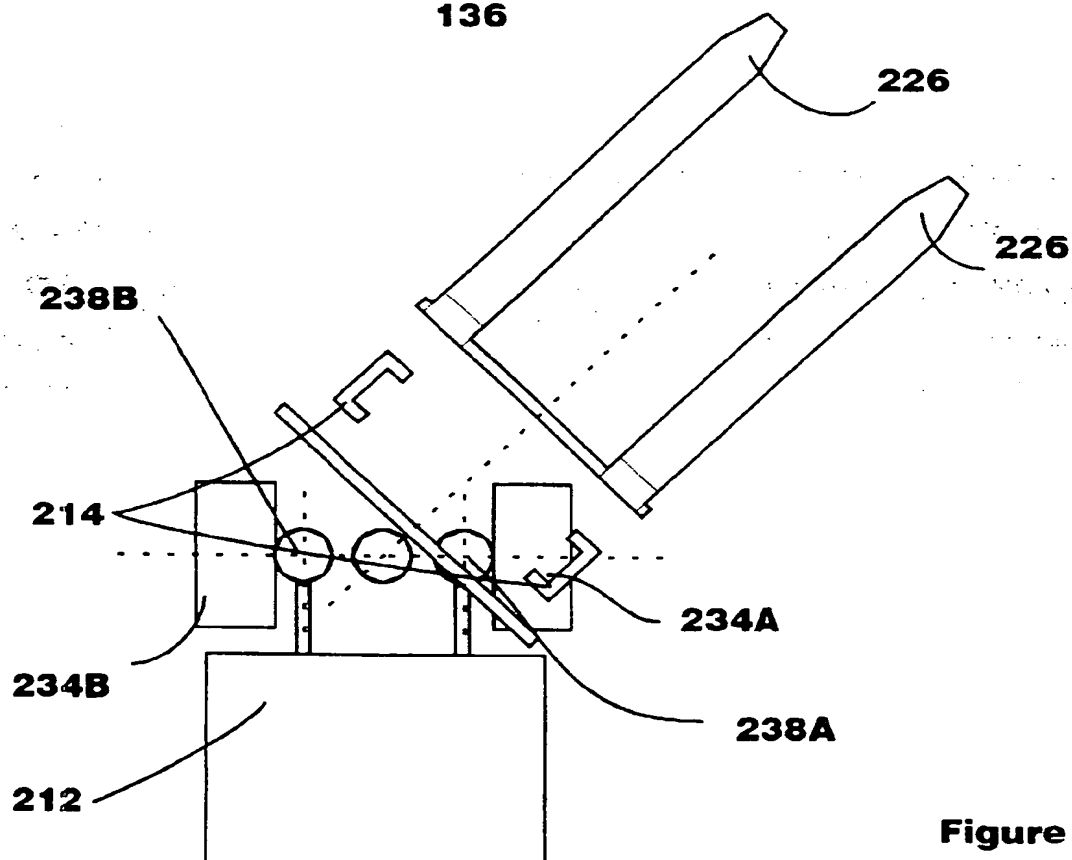


Figure 7

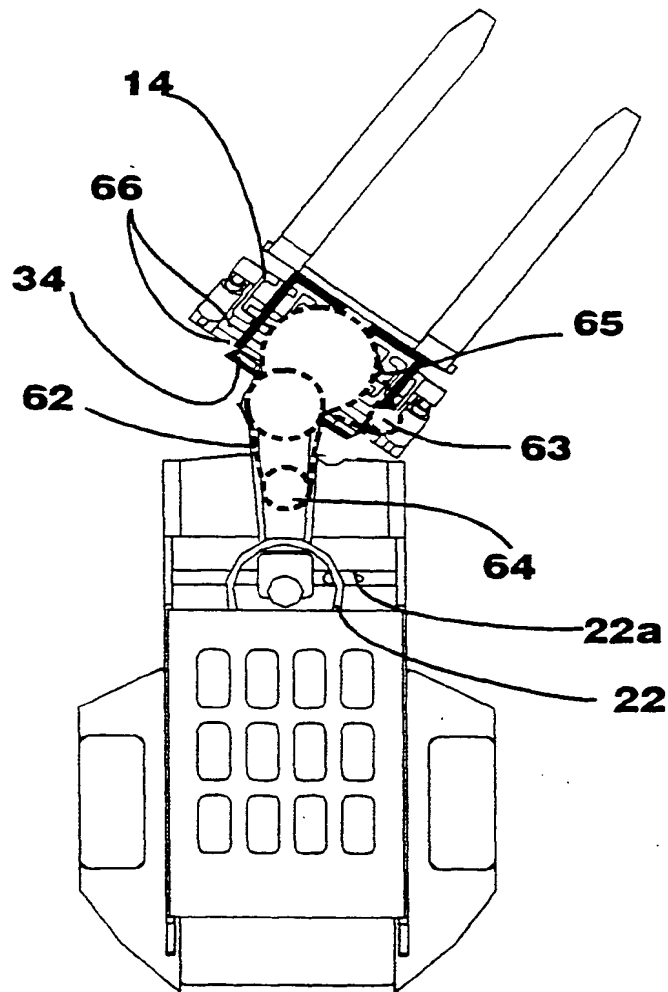


Figure 8



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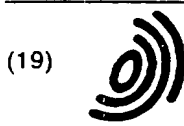
EUROPEAN SEARCH REPORT

Application Number
EP 98 30 0028

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US 3 225 949 A (ERICKSON)	1,2,4-9	B66F9/10
Y	* the whole document *	11-14	B66F9/075
Y	DE 11 31 146 B (K.H.D.)	11-14	
	* the whole document *		
X	US 3 216 598 A (MCKEE)	1-3,6-9	
Y	* the whole document *	11-14	
Y	GB 1 305 372 A (SHAW, TREW & SMITH)	11-14	
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A	US 2 284 237 A (STEVENSON)		
A	US 3 272 365 A (STEVENS)		
A	DE 16 80 249 A (R.M.W.)		
A	US 3 382 994 A (HOLLENBACH)		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B66F
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		11 May 1998	Van den Berghe, E
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(54) Lift truck

(57) A lift truck (10) for lifting crates of goods and the like comprising a body (12) having ground engaging means (16,34), a lifting device (14) having a mast and means (24) for lifting goods (26,28) with respect to the mast which lifting device is pivotally attached to the body

about a first axis (32), at least one steerable wheel (34) proximal the lifting device which wheel is pivotable about a second axis (40) to enable steering of the truck, and means for independently pivoting the lifting device about the first axis and the steerable wheel about the second axis.

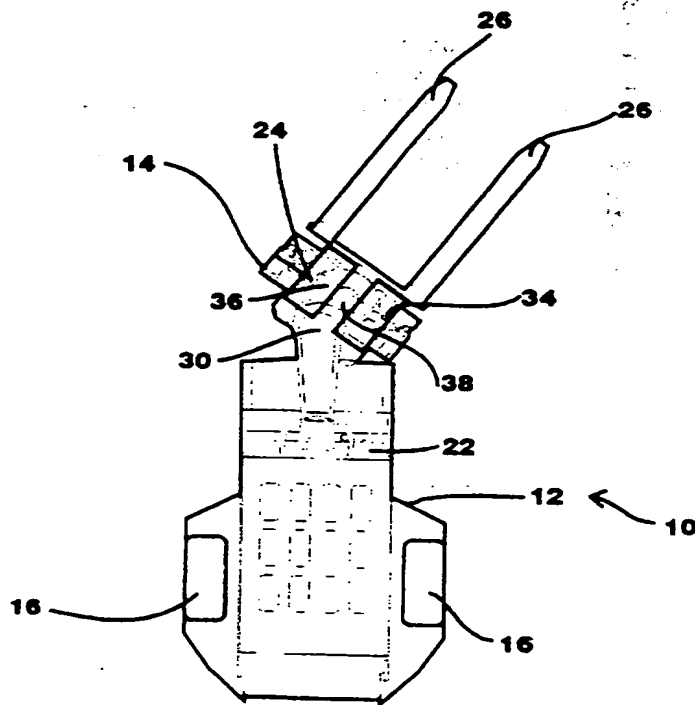


Figure 1

Description

The invention relates to lift trucks also known as forklift trucks used for manoeuvring loads such as crates of goods and the like. More particularly, the invention relates to such trucks adapted for use in narrow aisle warehouses which trucks are highly manoeuvrable.

A known truck of this type is disclosed in WO91/01938 which describes a narrow aisle lift truck having a pair of rear drive wheels and a forward pair of wheels fixedly attached to a lifting device comprising a mast, lifting mechanism and lifting forks. The lifting device is pivotally connected to the main body of the truck such that rotational movement of the lifting device about the pivot axis acts both to steer the direction of movement of the vehicle and any goods held by the forks. In order to provide increased manoeuvrability, WO91/01938 provides reversible independent drives to each of the rear wheels.

An object of the invention is to provide greater performance than that known from prior art trucks and especially to provide greater manoeuvrability in narrow aisles. A further object of the invention is to provide a truck capable of handling long loads in narrow aisle warehouses.

According to one aspect of the invention there is provided a lift truck for lifting crates of goods and the like comprising a body having ground engaging means, a lifting device having a mast and means for lifting goods with respect to the mast which lifting device is pivotally attached to the body about a first axis, at least one steerable wheel proximal the lifting device which wheel is pivotable about a second axis to enable steering of the truck, and means for independently pivoting the lifting device about the first axis and the steerable wheel about the second axis. Beneficially therefore the direction of movement of a truck can be determined by the steerable wheel and/or lifting device and the goods can be handled and directed in a different direction to the movement of the truck. Additionally, increased manoeuvrability is provided.

Preferably the second axis is positioned further from the truck body than the first axis and more preferably the steerable wheel is below the lifting means thereby to provide good stability of the truck in use.

In one form, the steerable wheel is pivotally attached to the lifting device and in another form the steerable wheel is pivotally attached to the body and therefore entirely independent of the lifting device.

Preferably the truck comprises two steerable wheels which are axially separated along a common rotational axis. In one form, the two steerable wheels are connected to the truck at a common pivot providing the second axis. Preferably the second axis is disposed between the wheels. In another form, the truck comprises two steerable wheels each being pivotal about independent second axes. Accordingly, each steerable wheel is attached to the truck, at either the body or the

lifting device, at a separate point.

According to another aspect of the invention a lift truck of the generally known type is provided wherein the body is adapted to allow a load operably to be positioned over part of the body thereby enabling the centre of gravity of the load to be kept close to the centre of gravity of the truck. Beneficially, the lifting device is adapted to position the load to one side of the body whilst still allowing the truck to move in a forward and other directions. Therefore, a long load can be positioned on the lifting device and preferably can also be supported by part of the truck body. For example, a body part above rear drive wheels can be kept low and a support means provided for the load in the vicinity of the body part.

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

FIGURE 1 is a plan view of a truck according to the invention;

FIGURE 2 is a side elevation view of the truck shown in Figure 1;

FIGURE 3 is a plan view of the truck shown in Figures 1 and 2 at four different stages of manoeuvring a load into a space;

FIGURE 4 is a rear elevation view of the truck shown in Figure 1 having a load positioned to the side of the vehicle;

FIGURE 5 is a plan view of the truck shown in Figure 4 during two stages of manoeuvring a long load;

FIGURE 6 is a partial plan view of a second embodiment of a truck according to the invention;

FIGURE 7 is a partial plan view of a third embodiment of a truck according to the invention; and

FIGURE 8 is a plan view of the invention showing in particular details of the drive mechanisms.

Referring to Figures 1 and 2, there is shown a truck 10 according to the invention comprising a body 12 and lifting device 14. Body 12 comprises a pair of rear wheels 16, a cabin 18 housing a seat 20 and steering and lifting controls 22 and 22a. The lifting device 14 comprises a mast 24, forks 26 and a mechanism 28 for raising and lowering of the forks on the mast. The lifting mechanism 28 can comprise hydraulic and/or chain and sprocket mechanisms for example. Lifting device 14 is pivotally attached to body 12 at a pivot hinge or bearing 30 having a pivot axis 32.

Truck 10 further comprises front steerable wheels 34 rotatable about a common horizontal axis 36. The

steerable wheels are pivotally attached by a pivot 38 having a pivot axis 40 to a plate 42. Plate 42 is in turn connected, in this embodiment, to lifting device 14. In this configuration, axes 40 and 32 are alignable along the longitudinal axis of the truck 10, with axis 40 furthest from the body 12, and beneath device 14.

Independent mechanisms (described later in relation to Figure 8) are provided for effecting rotation of the lifting device 14 about axis 32 and for rotating steerable wheels 34 about axis 40. Additionally, a drive system such as a combustion engine is provided in body 12 for driving any one of wheels 16 and 34. Preferably, means is provided for driving any wheel in a forward or reverse direction.

Figure 3 shows four different plan views of a procedure of placing a load L into a storage bay using truck 10. As can be seen from Figure 3a, truck 10 can be used with axes 40 and 32 substantially in line along the longitudinal axis of the truck to drive load L in a forward (or reverse) direction. To manoeuvre the load L into a storage bay (or other predetermined position) lifting device 14, and accordingly forks 26 and load L, are rotated about axis 30. The angle of movement of the truck and the load L can also be adjusted by rotation of steerable wheels 34 about axis 40. By suitable manoeuvring of steerable wheels 34 and lifting device 14, it is possible to maintain the truck body 10 substantially at right angles to the direction of movement of load L. Accordingly, truck 10 enables the positioning of loads L in narrow aisles.

A rear view elevation of truck 10 is shown in Figure 4 where a long load L is supported on forks 26. As can be seen in Figure 4, in this version cabin 18 is relatively narrow compared to the width of the body 12. Shoulder panels 44 are provided above wheels 16 and it is possible to carry a load L in a relatively low position wherein part of the load passes over a shoulder portion 44 of body 10 on one side of the truck. Indeed, it is possible, as shown in Figure 4 for load L to abut the shoulder 44. Shoulder 44 can be provided with internal supports for increased load handling. Beneficially therefore, whilst the centre of gravity of a long load should be positioned between forks 26, it is possible to carry some of the load on shoulder 44. Moreover, it is possible to keep the centre of gravity of the load close to truck 10 thereby to increase stability of the truck in use. Figure 5 shows the benefit of manoeuvrability of truck 10 in handling a long load L. Lifting device 14 is positioned at right angles to the longitudinal axis of the truck. This causes pivot 38 to be displaced to one side of the truck as shown in Figure 5a. However, the independent steering mechanism to steer wheels 34 enables the truck to continue in a forward direction. Additionally, the load can be manoeuvred sideways into an appropriate bay through suitable rotation by a driver of the steerable wheels and lifting device about axes 40 and 32 respectively.

A further embodiment of the invention is shown in Figure 6 wherein a pair of steerable wheels 134a and

134b is provided each having an independent rotation axes 136a and 136b respectively. Additionally, each steerable wheel 134a and 134b has a separate pivot 138a and 138b respectively and first axis about which it can be steered. In the embodiment shown in Figure 6 the pivots 138a and 138b are attached to lifting device 114. Beneficially the axial separation of steer wheels 134a and 134b along axis 136 provides greater lateral stability of a truck 100.

A further embodiment is shown in Figure 7 wherein wheels 234a and b each comprise separate pivots 238a and b respectively. The pivots are attached to body 212 independent of lifting device 214.

Referring to Figure 8, the independent drive means are shown. The complete assembly (i.e. the lifting device 14) is steered by rotating motor 64, which in turn drives steer chain 62. Steer wheels 34 are steered by rotating motor 63, which in turn drives steer chain 65.

The motor could be hydraulic or electrically controlled. Power from the steering wheel 22 can be directed to either motor 63 or 64. Both motors steer the truck, however with motor 64 the whole assembly (14) turns (i.e. the mast, forks and steer wheels).

For example a switch can be provided such as a lever to change control by the steering wheel to either motor 63 or 64. However, a separate steering wheel can be provided to drive motor 63 and accordingly a driver can, with practise, steer the truck using both steering wheels at the same time.

When steering motor 63 is powered then only the steered wheels 34 turn, leaving the forks stationary. This increases manoeuvrability dramatically. The lifting mechanism 14 is mounted above the steer wheels 34 and consists of a conventional telescopic construction. It could be fed hydraulically and is fixed above plate 66. To turn the forks together with the lifting mechanism 14, motor 64 is powered by operating the steering 22 through that particular circuit. The forks are normally powered up and down by hydraulic pressure operated by a separate hand control lever 22a.

Claims

1. A lift truck for lifting crates of goods and the like comprising a body having ground engaging means, a lifting device having a mast and means for lifting goods with respect to the mast which lifting device is pivotally attached to the body about a first axis, at least one steerable wheel proximal the lifting device which wheel is pivotable about a second axis to enable steering of the truck, and means for independently pivoting the lifting device about the first axis and the steerable wheel about the second axis.
2. A lift truck according to Claim 1 wherein the pivoting means enables the direction of movement of a truck to be determined by the steerable wheel and/or lift-

ing device and the goods to be handled and directed in a different direction to the movement of the truck.

3. A lift truck according to Claim 1 or 2 wherein the second axis is positioned further from the truck body than the first axis. 5
4. A lift truck according to Claim 1, 2 or 3 wherein the steerable wheel is below the lifting means thereby to provide good stability of the truck in use. 10
5. A lift truck according to any preceding claim wherein the steerable wheel is pivotably attached to the lifting device. 15
6. A lift truck according to any of Claims 1 to 4 wherein the steerable wheel is pivotably attached to the body and therefore independent of the lifting device.
7. A lift truck according to any preceding claim which comprises two steerable wheels which are axially separated along a common rotational axis. 20
8. A lift truck according to Claim 7 wherein the two steerable wheels are connected to the truck at a common pivot providing the second axis. 25
9. A lift truck according to Claim 8 wherein the second axis is disposed between the wheels. 30
10. A lift truck according to any of Claims 1 to 8 comprising two steerable wheels each pivotal about independent second axes. 35
11. A lift truck according to any preceding claim wherein the body is adapted to allow a load operably to be positioned over part of the body thereby enabling the centre of gravity of the load to be kept close to the centre of gravity of the truck. 40
12. A lift truck according to Claim 11 wherein the lifting device is adapted to position the load to one side of the body whilst still allowing the truck to move in a forward and other directions. 45
13. A lift truck according to Claim 11 or 12 wherein a long load is positionable on the lifting device and supportable by part of the truck body. 50
14. A lift truck according to any of Claims 11 to 13 wherein a body part above rear drive wheels is low and support means is provided for a load in the vicinity of the body part. 55

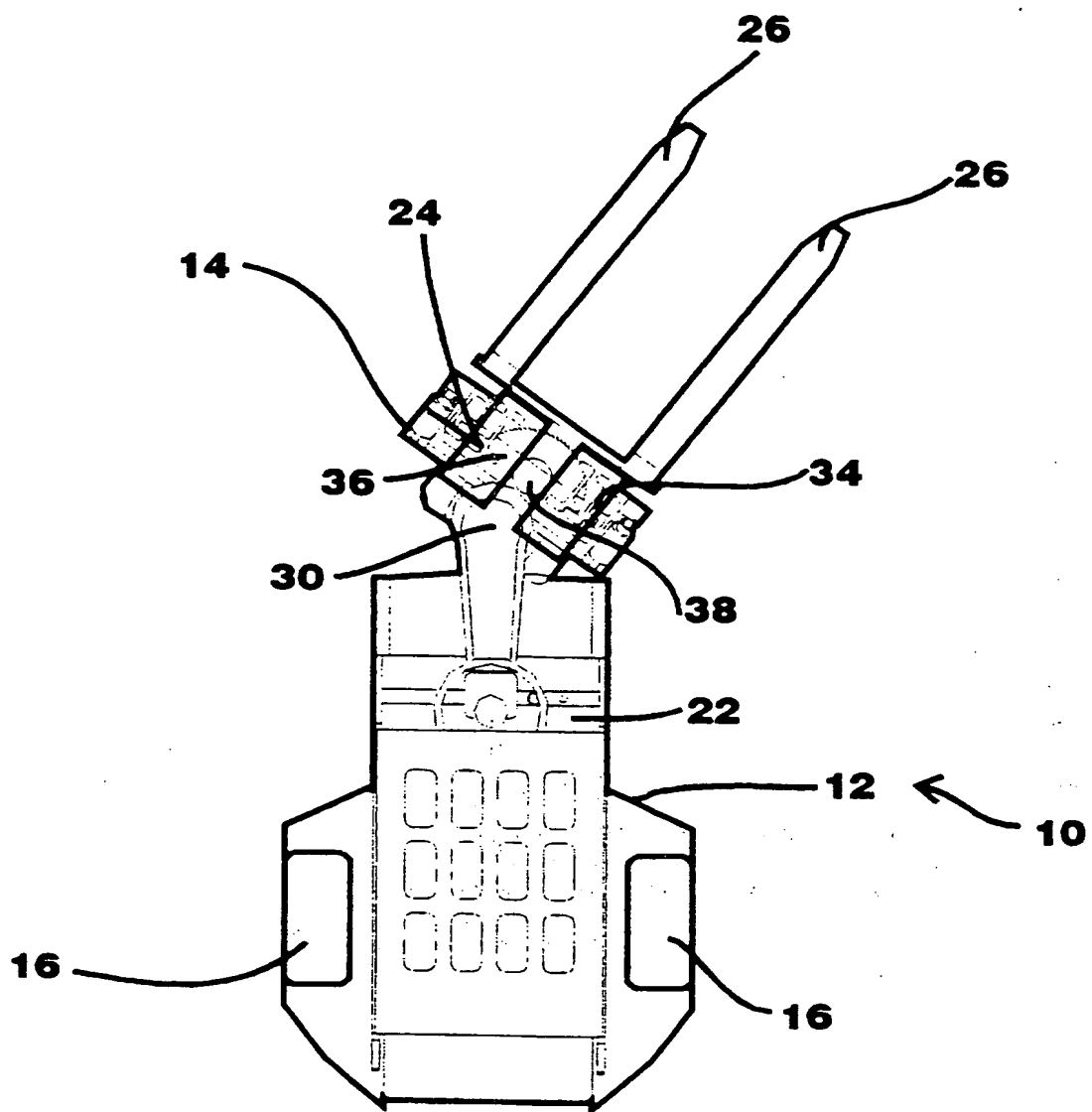
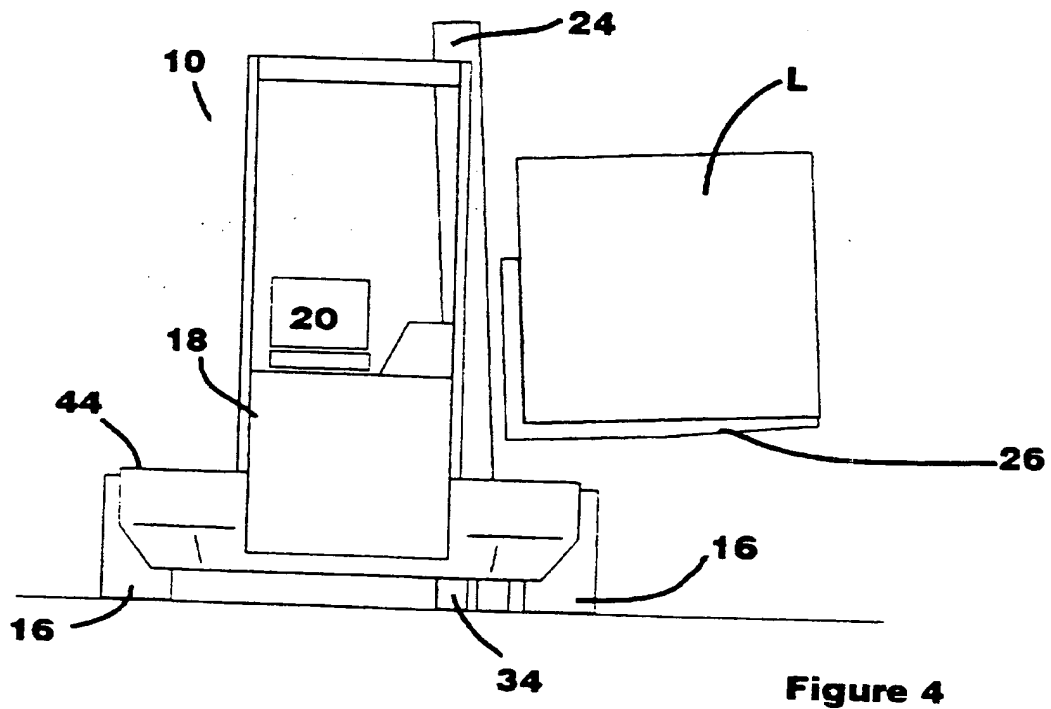
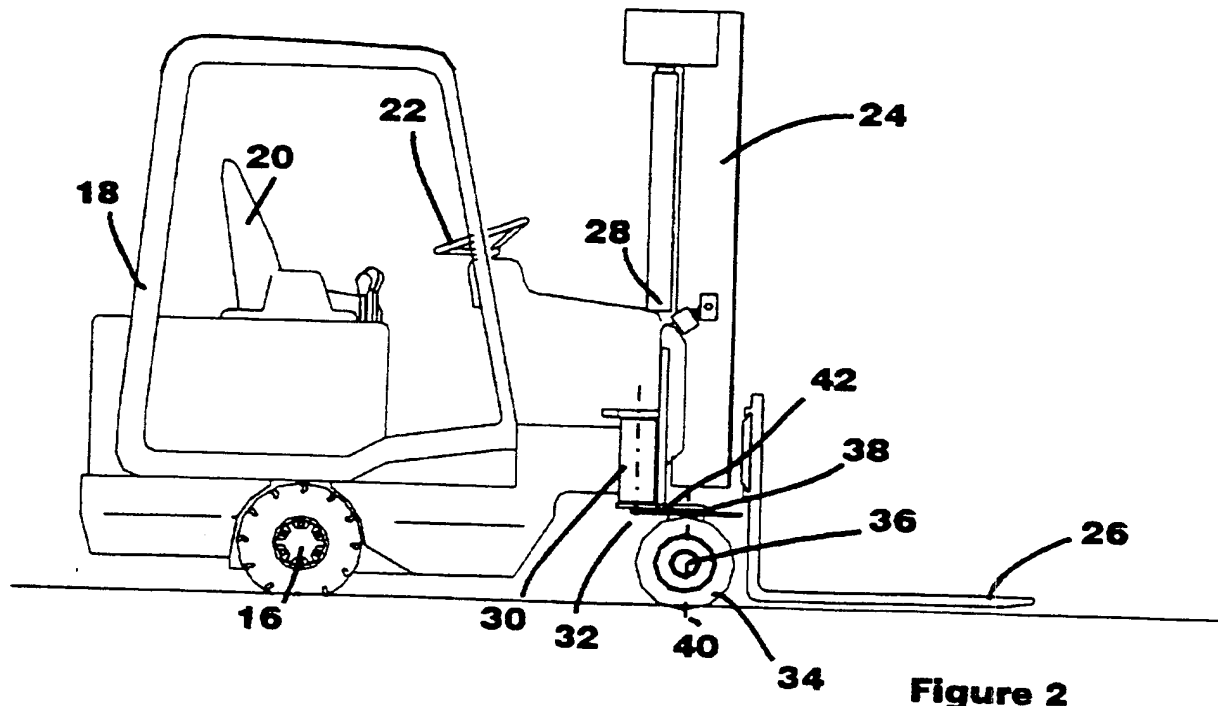


Figure 1



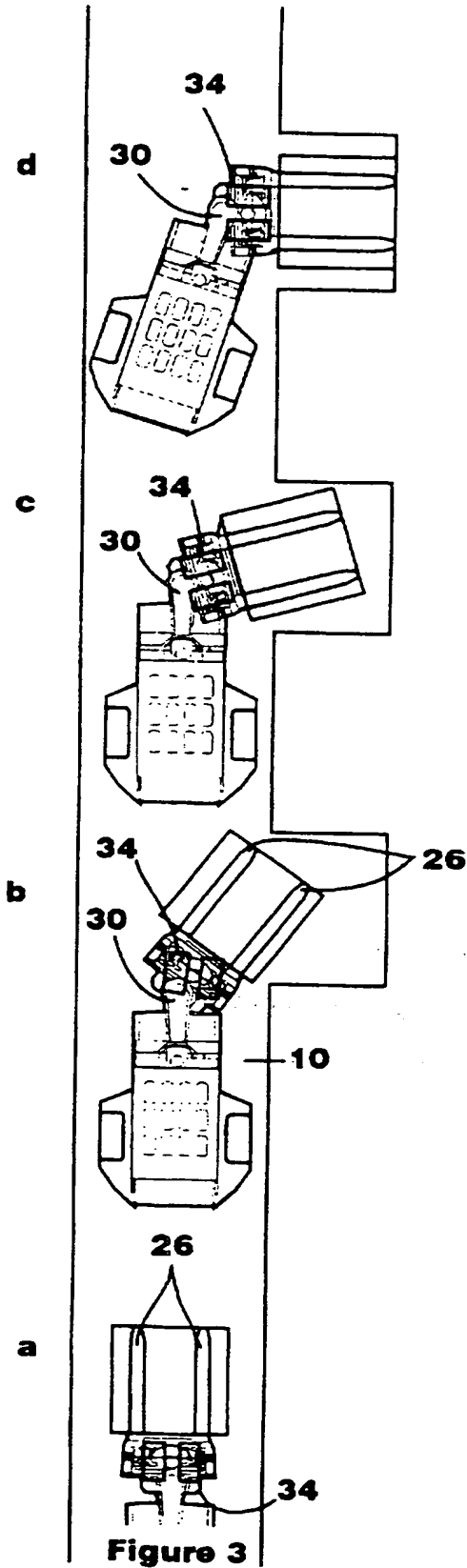


Figure 3

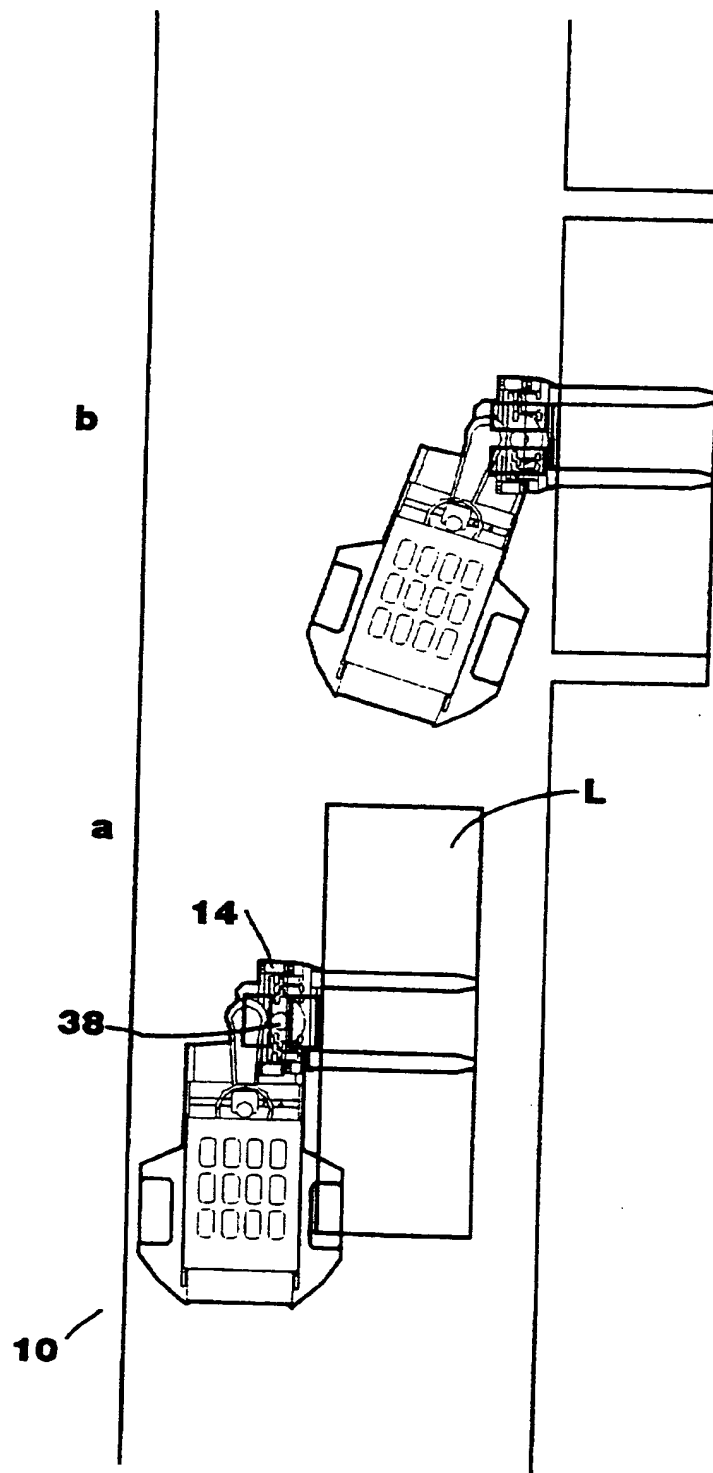


Figure 5

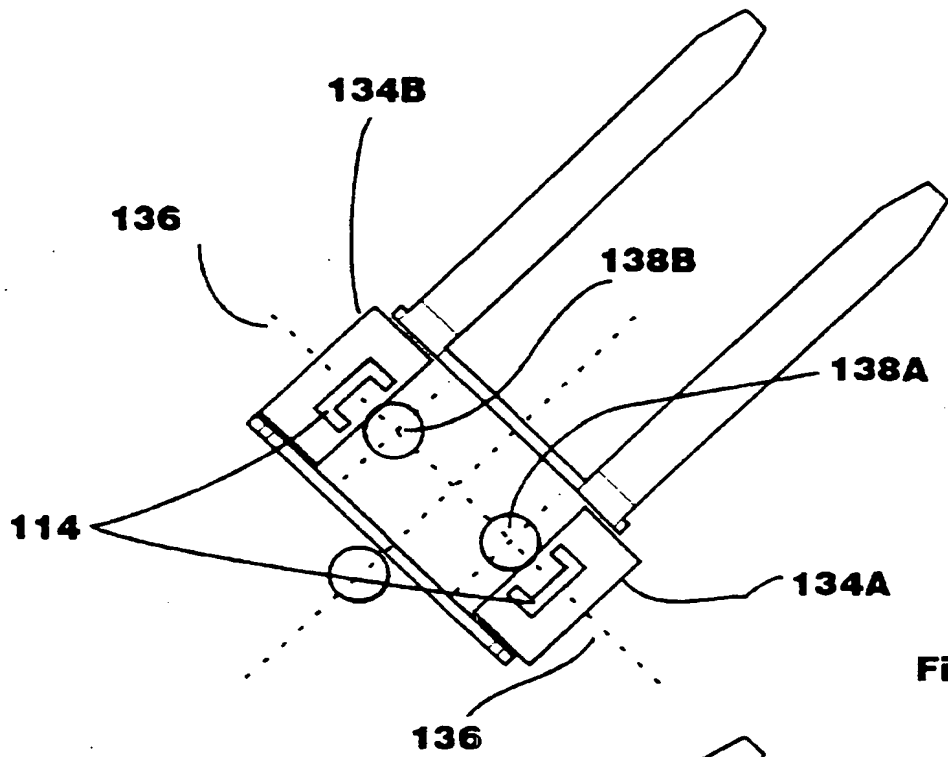


Figure 6

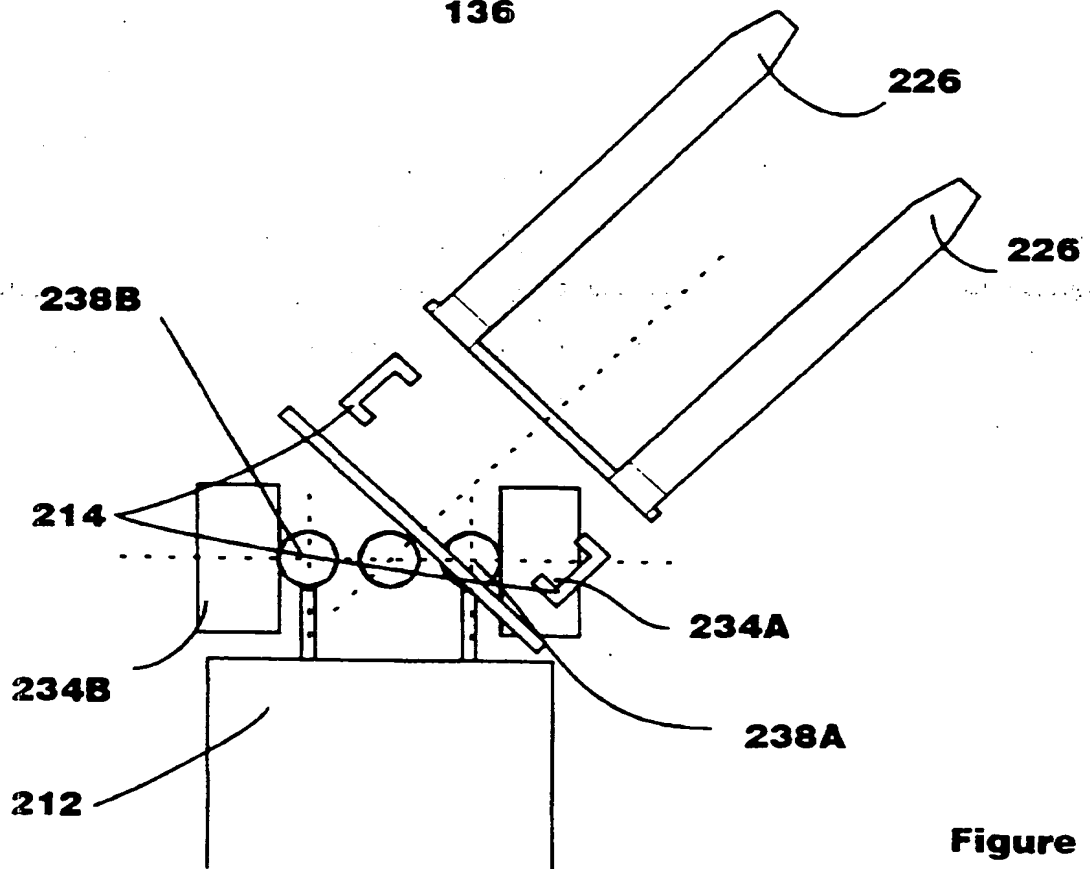


Figure 7

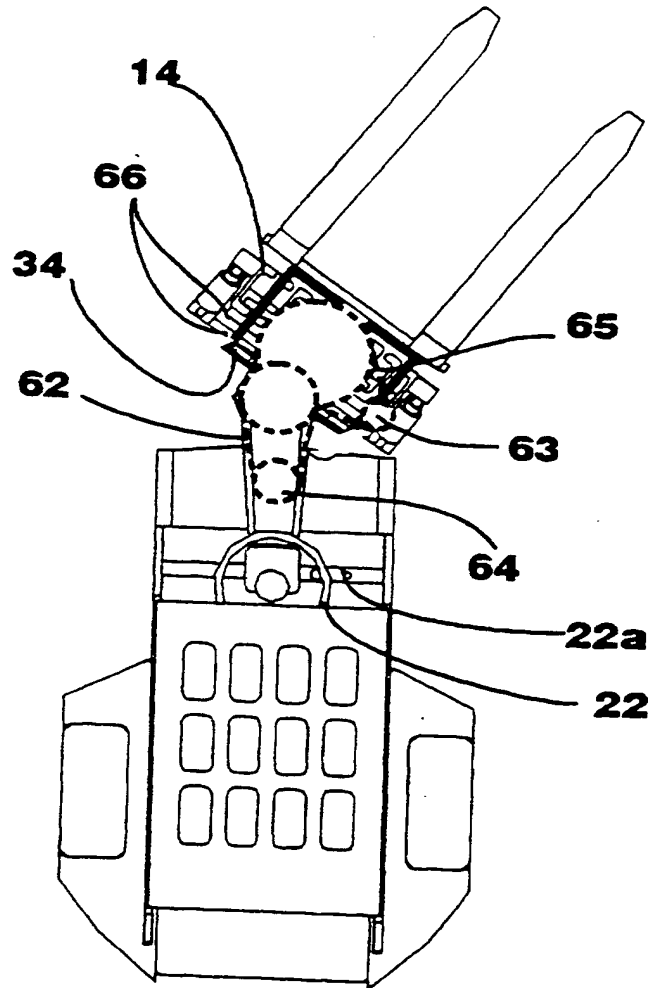


Figure 8



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 30 0028

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US 3 225 949 A (ERICKSON)	1, 2, 4-9	B66F9/10 B66F9/075
Y	* the whole document *	11-14	
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Y	* the whole document *		
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A	DE 16 80 249 A (R.M.W.)		
A	US 3 382 994 A (HOLLENBACH)		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B66F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 11 May 1998	Examiner Van den Berghe, E
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